United States Patent [19]

Okazaki

[11] **3,781,998**

[45] **Jan. 1, 1974**

[54] **INSIDE MICROMETER COMPRISING A COUNTER**

[75] Inventor: **Katsutoshi Okazaki,** Kure, Japan

[73] Assignee: **Yehan Numata,** Tsurumi-ku, Yokohama, Japan

[22] Filed: **Feb. 1, 1972**

[21] Appl. No.: **222,566**

[30] **Foreign Application Priority Data**

Apr. 2, 1971 Japan 46/24882

[52] **U.S. Cl.** ..... **33/166,** 33/164 C

[51] **Int. Cl.** **G01b 5/00**

[58] **Field of Search** ..... 33/164 R, 166, 164 C, 33/165

[56] **References Cited**

UNITED STATES PATENTS

981,127	1/1911	Scusa	33/166
2,691,224	10/1954	Thielicke	33/166
3,667,127	6/1972	Tsugami	33/164 R

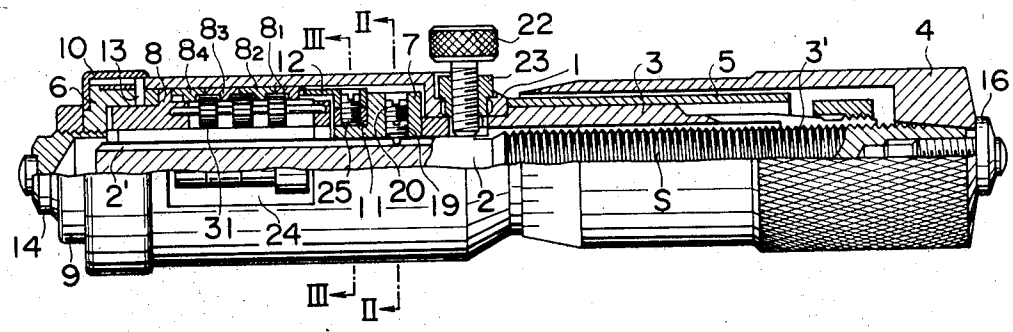
Primary Examiner—William D. Martin, Jr.

Attorney—Joseph F. Brisebois et al.

[57] **ABSTRACT**

Compact inside micrometer comprising counter directly or indirectly connected to a guide which operates scale-carrying rings in the counter through a connecting bush interlocked with a spindle. The counter may be adjusted by separating the connecting bush from the guide.

1 Claim, 4 Drawing Figures



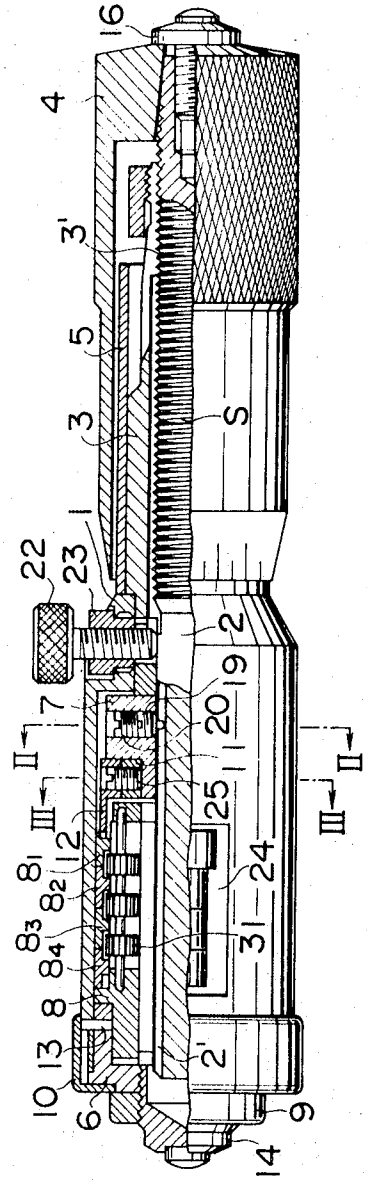


FIG. 1

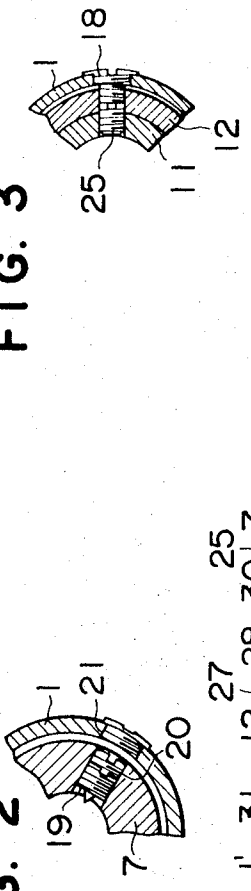


FIG. 2

FIG. 3

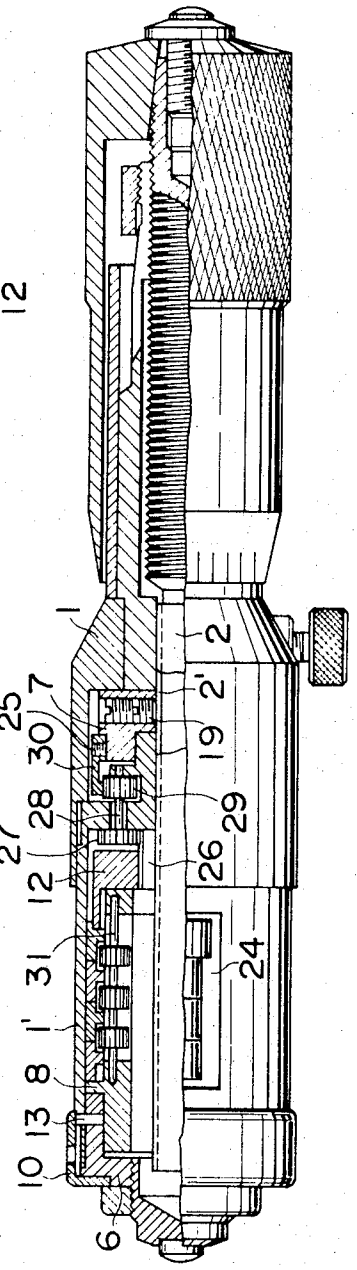


FIG. 4

INSIDE MICROMETER COMPRISING A COUNTER

SUMMARY OF THE INVENTION

The present invention relates to an inside micrometer comprising a counter.

Ordinary inside micrometers have heretofore had counters externally attached thereto, and the resulting combination has accordingly been inconveniently bulky.

It is an object of the present invention to provide a compact inside micrometer comprising a counter which is not undesirably bulky.

Another object of the present invention is to provide such a micrometer in which the rotational force of a spindle is transmitted through intermediate means to a scale-carrying ring forming part of the counter which ring is mounted coaxially around the spindle for the sake of compactness.

It is still another object of the present invention to provide such a micrometer in which the zero point of the counter can be readily adjusted, by separating the intermediate means from its connection to the spindle.

A further object of the present invention is to provide a micrometer in which the rotation ratio between the spindle and the counter may be set at a desired value by using a set of gears which change the speed of the said intermediate means.

Other objects of the present invention will be apparent from the following detailed description of the invention with reference to the accompanying drawings, in which:

FIG. 1 is a side view of my new micrometer comprising a counter means, with half of its external parts broken away;

FIG. 2 is a sectional view taken along the line II—II of FIG. 1;

FIG. 3 is a sectional view taken along the line III—III of FIG. 1, and

FIG. 4 is a side view, partially in section, of another embodiment of the present invention.

In the embodiment of FIGS. 1–3, the structure in the right half of FIG. 1 is the same as that of an ordinary inside micrometer. This is, the externally threaded portion S of a spindle 2 is engaged in the internally threaded part 3′ of the internal sleeve 3 and a thimble 4 is attached to the end of the spindle 2 by a screw 16. One end of this thimble carries indicia used in measuring. Reference numeral 5 indicates an outer sleeve rigidly attached to the cylindrical periphery of the internal sleeve 3. The outer surface of this sleeve carries a base line for measurement, which cooperates with the scale on the thimble. The spindle 2 is formed with a longitudinal groove which receives a key in the form of a screw 19, hereinafter described in greater detail.

An outer body member 1 carries at one end a cover 6 rigidly attached thereto by a cap 10. An adjustable stop 14 is screwed into the cover 6 and held tightly in place by a nut 9. Counter means 8 encircles the cylindrical surface of the spindle 2, and is rigidly attached to the cover 6 by a pin 13 which prevents rotation of the counter means 8. The casing of the counter means 8 is substantially cylindrical in form, and carries four rotatable counter scale rings 8_1, 8_2, 8_3, 8_4. These rings are mounted coaxially of the spindle 2.

As the counter scale rings are of a conventional type, the description thereof will be abbreviated. The main structure and function thereof are as follows. First, the

scale ring 8_1 which is a first stage ring and denotes a number having one digit, is rotated for one revolution by the guide ring 12, then the next stage ring 8_2 is so rotated by the driving gear 31 that it turns through a predetermined angle, and the third and fourth scale rings are rotated in their turns in a similar manner. The connecting bush 7 loosely mounted on the spindle 2 rotates therewith due to the presence of the tip of the key 19 in the groove 2′. Reference numeral 20 indicates a stop screw for the key 19. A guide ring 12 is rigidly mounted on the connecting bush 7 and rotates the scale rings. The connecting bush acts through a ring-shaped guide bush 11 to which it is connected by a set screw 25. Access to this set screw 25 may be attained by removing a screw 18 which is set in the outer body 1 as shown in FIG. 3. By loosening the set screw 25, the guide bush 11 and the guide ring 12 are freed to rotate around and against the connecting bush 7, thus making it possible to regulate the zero point of the counter. Besides, as shown in FIG. 2, access to the set screw 19 and the set screw 20 is attained by removing a screw 21, thus permitting adjustment of the engagement between the set screw 19 and the key 2′. The guide ring 12 is connected to the scale ring so as to move therewith. Therefore, operation of the thimble 4 moves the spindle 2 to the right in FIG. 1. Then the connecting bush 7 rotates at a predetermined position while interlocked with the spindle 2 by the key screw 19 and the key groove 2′. This rotating movement is transmitted to the first stage scale ring 8_1 in the counter means by the guide ring 12, and then to the other scale rings in the counter in their turn. The change in the figures on the counter is read through a window 24 in the body 1, and vernier measurement is carried out by using the thimble scale jointly at the same time. In the drawing, reference numeral 22 indicates a clamp screw for the spindle and reference numeral 23 a bush receiving the screw 22.

The second embodiment is shown in FIG. 4. While in the first embodiment the spindle and the counter rotate in a ratio of one to one, in the second embodiment they rotate in a ratio of 1 to 2.5. To this end, speed increasing gear means is provided. In the description of the second embodiment, the same reference numerals identify parts substantially identical to corresponding parts in the first embodiment. A ring gear 30 is fastened to the bush 7′ by a screw 25. Access to this gear is easily attained by removing a screw (not shown in the drawings) in the outer body 1.

The ring gear 30 meshes with a pinion 29 which is rotatably mounted on a shaft 28 supported by the side wall forming part of the outer body 1, and the pinion 27 rotatably mounted on the same shaft 28 is in engagement with a gear 26 which is rotatably mounted on the spindle 2. The guide ring 12 is attached to the gear 26 to rotate therewith. Therefore, rotation of the spindle 2 turns a connecting bush 7′, an initial gear 30, the pinions 29, 27, the gear 26, and the guide ring 12 to change the figures in the counter, and the figures are read through a window 24.

In this second embodiment, by releasing the connection between the connecting bush 7′ and the internal gear 30, the zero point of the counter means may be adjusted, and the position of the connecting bush on the spindle may be adjusted. Moreover, as the counter means encircles the spindle, its structure is compact, like that of the inside micrometer.

What is claimed is:

1. In an inside micrometer comprising an externally threaded spindle which is longitudinally advanced by relative rotation between said spindle and a concentric sleeve having internal threads engaging said external threads in said spindle, a thimble for causing such relative rotation and a digital counter comprising a plurality of scale-carrying rings encircling said spindle which indicate the distance through which said relative movement occurs, the improvement according to which the motion of said spindle is transmitted to said counter through a transmission comprising:

a connecting bush encircling said spindle and carrying an adjustable key slidable in a longitudinal key way in said spindle, whereby said bush rotates with said spindle, and

a guide ring, which is coaxial with and encircles said spindle, releasably connected to said connecting bush and interlocking with a first scale-carrying ring in said counter, and gear means transmitting movement from said first scale-carrying ring to the remaining scale-carrying rings,

said connecting bush, guide ring, and gear means being housed within a cylindrical zone concentric with, but having a smaller external diameter than said scale-carrying rings.

* * * * *